UNITED STATES PATENT APPLICATION

of

COREY BILLINGTON

and

CHRIS BRADLEY

FOR

WIRELESS ULTRA-THIN CLIENT NETWORK SYSTEM

TO THE COMMISIONER OF PATENTS AND TRADEMARKS:

Your petitioners, **Corey Billington,** a citizen of the United States, whose residence and postal mailing address is **1072 Warren Avenue, San Jose, California 95125**, and **Chris Bradley,** a citizen of the United States, whose residence and postal mailing address is **1245 Crompton Road, Redwood City, California 94061**, pray that letters patent may be granted to them as the inventors of a **WIRELESS ULTRA-THIN CLIENT NETWORK SYSTEM** as set forth in the following specification.

WIRELESS ULTRA-THIN CLIENT NETWORK SYSTEM

This application is a Continuation - in - Part of U.S. Patent Application Serial No. 09/907,212 filed July 16, 2001, the disclosure of which is incorporated herein by reference for the relevant teachings consistent herewith.

BACKGROUND OF THE INVENTION

The invention relates generally to information systems. More specifically, the invention relates to configuring devices and systems to accommodate and provide lower cost and convenient connectivity between various devices such as servers, client workstations, and shared peripherals and data storage devices in a network environment. Such environments include, but are not limited to: wired and wireless office, home, and facility-wide network environments.

In data processing systems, such as networked personal computers (PCs), and server-client networks, PCs, clients and peripheral devices are customarily connected to each other and/or to a server. Typically, a cable connection to each is provided, along with network logic to tie the PCs together into a network or to tie PCs to a server with greater processing power and/or greater data storage capability. Shared peripheral devices can include one or more hard drives, and can include a redundant array of independent drives (RAID). Printers are very commonly provided as a shared peripheral device in a network environment. They can be directly connected to a PC or server, or can be located elsewhere. In the latter case a local area network (LAN) card or other network logic is typically used to create a node on the network. The printer is connected to this node, and a plurality of network-connected users can share the printer device.

Conventionally, however, a PC is provided at each networked workstation, whether all PCs are tied to a server, or simply to each other. Other peripheral devices that users may need from time to time can be connected to user workstation PC(s). For example, hard drives, optical and magnetic media drives, sound systems for audio reproduction, and other devices can be, and typically are, connected to each workstation PC. These can be shared devices, or can be configured to be readily accessible only by the user at the workstation itself. Typically, clients in a network environment connect to a mass data storage device such

as a server-connected hard disk, RAID drive, tape drive, etc. through the network. Also, as discussed above, some peripherals, (*e.g.* printers), are often shared, and are made accessible through a network.

Generally the connection of peripheral devices to the data processing device (server or PC) may be direct, or via a network, and again generally speaking is hard-wired. Wireless data transfer devices are known, but are not widely preferred in networking applications because of higher cost and other considerations. Currently, some devices such as FireWire and other high performance bus devices require that they be hard-wired, and can have a wire length limit. It is reasonable to assume that in the future high speed data transfer schemes will be developed that will not be thus limited.

Nevertheless, individual user workstations continue to typically comprise PCs, with relatively powerful, and costly, processors, hard drives, and other peripherals, at each station. In this day of emerging connectivity possibilities, this can be a somewhat wasteful disposition of resources, in that costly items are reproduced at each workstation, and are underutilized, generally speaking. A user at a workstation conventionally will frequently use a workstation hard drive carried by a PC; but media drives, scanners, printers, and other devices, are typically used less frequently. Moreover, a collection of devices, such as printers, scanners, etc. with associated cords and cables can accumulate around the work area of a user of a data processing device at a workstation. These can take up space that may more profitably be put to other uses; as, again, these peripherals are not used most of the time.

Moreover, as alluded to above, there can be situations where a processor, such as a PC or a server used in a network is located in a place remote from users of the processor. This can be a place such as a different room, different part of a room, different floor of a building, etc. Further, in a conventional network, shared resources such as the server, printer(s), scanner(s), etc. can be, and typically are, located at locations remote from the workstations; and are connected by a hard-wired or wireless connection scheme to the network. This can be desirable to reduce costs, or to isolate the processor.

Isolation of the processor can be desirable when, for example, its cooling fan is deemed too noisy for the user location or when a specific area for shared resources is desired. For example, in many network environments such an area can be specially adapted for location of the processor. Special cooling, noise isolation, or centralized location of the processor and one or more shared devices may be desired. Another example is where the environment at the user(s) location(s) is potentially damaging to the processor due to

temperature, humidity, or particulate content of the air. In this scenario, convenient connectivity can be more difficult.

One scheme which can address some of the afore-mentioned difficulties, depending upon the application, is provision of "thin client" systems. Here, at least one server or PC is made to function as a processing center, and one or more "stripped-down" client workstations are connected. The thin client can simply be a monitor, mouse and keyboard with minimal logic, for example. This scheme leverages the processing power of the server or PC, rather than locating considerable processing capability at the client workstations. Peripheral devices are also connected directly to the processor (server or PC) rather than the thin client workstation, and a group of peripherals can be connected to the processor and physically located at a central location.

As will be appreciated, however, cabling can be a difficult issue. Each thin client can have 2, 3, or more cables to connect to the processing center. For example, each client can have a monitor, keyboard and mouse cable; and, further, audio systems, video cameras, game consoles/joysticks, and other devices may be desired at one or more thin clients. This can require running multiple cables to multiple sites. This amount of cabling may not be acceptable or practical in home environments. It may not be convenient or desirable even in office or facility environments where false ceilings and cable raceways may make it less cumbersome.

SUMMARY

It has been recognized that consolidation and interconnectivity of data processing devices within a network is desirable, for at least the reasons mentioned above. The invention accordingly provides an ultra-thin client network system, comprising: 1) a processing center including: a) a processor; b) a data bus in data communication with the processor; c) a concurrency device, operatively coupled to the data bus; and, d) a wireless data connection, operatively coupled to the concurrency device; and, 2) a plurality of ultra-thin clients, each further comprising a communication device including a wireless data connection, whereby each of the ultra-thin clients can be in data communication with the concurrency device, and can be located in relation to the processing center without cabling, and can share in a processing capability of the processing center. Further features and advantages of the invention will be appreciated with reference to the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, such features and advantages.

Brief Description of the Drawings

FIGURE 1 is a schematic block diagram illustrating an example ultra-thin client network system according to an embodiment of the invention.

FIG. 2a, b are each perspective views of a wireless connection device in an example according to an embodiment of the invention.

FIG. 3 is a schematic perspective view of an ultra-thin client network system implemented in a home environment in an example according to an embodiment of the invention.

FIG. 4 is a schematic perspective view of an ultra-thin client network system configured to be implemented in office or facility or workgroup environment in an example according to an embodiment of the invention.

FIG. 5 is a schematic block diagram of an ultra-thin client network system example according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

By way of background, and to be clear and consistent, generally when referring to a processor herein it shall be understood to generally refer to the central processing unit (CPU). That is to say, the CPU refers to that part of a computer which controls other parts. Designs vary widely but, in general, the CPU consists of the control unit, the arithmetic and logic unit and memory (registers, cache, RAM and ROM as well as various temporary buffers and other logic).

When speaking of an "ultra-thin" client (UTC), generally what is referred to is one that has essentially no CPU at the location of the client. That is to say, at the location of the ultra-thin client workstation, devices such as a monitor, a keyboard, a pointing device such as a mouse, an audio reproduction device, a joystick or other gaming device, and other peripheral devices can be present, but they are essentially connected to a remote processing center and perform essentially a user interface function. While such peripheral devices themselves may have inherent processing capability and can comprise microprocessor(s) or other hardware/firmware, there is essentially no CPU processing, and data is communicated to and from the separate locations of the processing center and the ultra-thin client(s), enabling essentially the CPU function at one location and a user interface function at another location. Multiple UTCs allow a single CPU to provide processing for multiple users at multiple locations.

When referring to a concurrency device, what is meant is a device configured for enabling "multi-tasking", "multi-processing", "multiprogramming", or "process scheduling." That is to say, such a device employs techniques for sharing a single processor between several independent jobs.

As used herein, the term "system bus" refers to the external bus (as opposed to an internal bus within the CPU) which ties the various functional units and peripheral devices together. Various design schemes, speeds, etc. are known. A peripheral connection interface (PCI) bus is one example of many known examples.

The terms remote, and remotely, as used herein, refer simply to a locale different from one being considered. This can be a few feet or a few miles. To illustrate, devices which are placed in close proximity, in the same small room, or cable-connected in the same part of a large room, exemplify devices which are not remote from each other. Devices which are not adjacent, are located in different rooms or buildings, are separated in a larger room by significant distance, or are wirelessly connected across a significant distance (say more than a few feet). These exemplify devices which would be considered remote from each other.

Peripheral devices shall mean powered devices connectable in a data-transferring manner to a processor. Such peripheral devices can include devices such as monitors, keyboards, mice and other pointing devices, printers, image capture devices such as scanners and digital still and motion video cameras, wired and wireless connection devices, and data storage devices such as hard drives, zip drives, CD-R and CD-RW drives, floppy drives, DVD and DVD-RW drives. Also included are connectivity enhancing hub/routing/switching devices such as an external data bus hubs which can incorporate routing logic and a plurality of data ports, and wireless data transmission devices.

As to all these definitions, the meanings set out above are intended in this specification, unless from the context another meaning is clearly implied. Also, these definitions are intended to elucidate but not limit the meanings of the words and phrases defined.

Returning to the connectivity problem, it will be apparent that connecting numerous devices within a network to a processor can be problematic in some circumstances, particularly where cabling difficulties and cost are issues. With that in mind, providing an ultra-thin client network which wirelessly connects a plurality of workstations comprising ultra-thin clients to a single processing center can provide increased convenience and usefulness at a reduced cost over conventional networking schemes.

With reference to FIG. 1 of the drawings, in one example embodiment of the invention an ultra-thin client network (UTCN) system 10 is illustrated schematically. A processing center 12 can include a personal computer (PC) 14, a server, or the like, having a PCI or other data bus 15. It also comprises a concurrency device 16 which leverages the data processing capability of the processor of the PC or server so as to be concurrently useable by a number of ultra-thin clients, *e.g.* 18, 20, 22, etc.

This scheme can be desirable, in that it can provide opportunities to save costs associated with providing processing and peripheral devices at each workstation of a network (not shown). The concurrency device 16 enables this leveraging in an economical manner. Concurrency devices are known and commercially available. Examples of such a device are available from ThinSoft (USA) Inc. of Emeryville, CA. Products such as the BUDDY™ and BETWIN™ marketed by that company are commercially available. These devices connect to the PCI, and software allows a plurality of monitors, keyboards, mouse devices, etc. to be connected to one processor and use it "concurrently." Actually, it will be appreciated that the connected additional thin clients share processing time sequentially, but the delays are typically not large enough to be frustrating to users. However, as will be further discussed below, the concurrency device 16 herein differs in that it is not directly cable-connected to the thin clients 18, 20, 22, etc.

The ultra-thin clients 18, 20, 22, etc. can each include one or more input/output (I/O) devices such as a monitor 24, keyboard 26 and a pointing device such as a mouse 28. A greater number or fewer number of components can be included at each thin client location, as will be further discussed below. As a result, each of the thin clients can comprise I/O interfaces between a user and the processing center. In addition to that thin client I/O device(s) shown, others can be provided if desired. Though not shown in this figure, one or more of a printer, a joystick or game console, a projector, an image capture device, a plotter, a scanner; and, an audio reproduction device, comprise examples of additional I/O devices that can be provided at the location of a thin client, as discussed in more detail below. However, often it is desirable to centrally locate many of these later exemplary devices, as they are often shared by a number of users. They can be located at the processing center an directly connected there. In another embodiment a thin client adapted to facilitate a particular activity can include one or more of these latter-mentioned I/O devices related to that activity.

Each UTC 18, 20, 22...etc., in the illustrated embodiment further comprises a data communication device 30. This device cooperates with the concurrency device 16 to allow different applications running on the PC/server at the processing center 12 to be accessed and

run simultaneously from the different thin clients, e.g. 18, 20, 22. The data communication device can be hard-wired to the processing center, or can be connected by a wireless connection 32. Transponders and logic for providing a wireless data connection are known. Examples of current systems include those using Bluetooth and WiFi protocols. Development of other systems, including high-speed synchronous and asycrounyus systems, seems likely.

The concurrency device 16 and a transponder of the wireless connection 32 can be separate devices, or can be combined in one card connectable to the system data bus 15. The frequencies used by the wireless connection and positioning and configuration of an antenna shown schematically at the wireless connection 32 can be as required to minimize RF interference. The antenna can be carried by card combining the wireless connection device and the concurrency device, and in another embodiment can be positioned elsewhere and be electronically coupled thereto.

The processing center 12 can further include other peripheral devices, such as data storage devices *e.g.*, a hard drive 34, or array of drives, etc. A media drive 36 such as floppy, zip, CD/DVD/RW or the like, can be included. Other peripherals, such as a modem or other network communication device 38 can be included. For example, in the case of a PC, these can be connected in one or more available bays or card slots, and can be connected to a system data bus 15. This can be by means of a conventional connected PCI in the illustrated embodiment. In one embodiment the concurrency device 16 is also thus connected using a PCI card connected to the PCI 15 and in communication with the processor 14. It is also in communication with the data communication device(s) 30 of the UTCs clients 18, 20, 22, etc. by the wireless connection 32.

A shared printer 40 can be located adjacent the processing center 12. It can be wire 42 connected or use a wireless connection. In one embodiment the printer connection can be wireless or share a wireless communication device 32 with the concurrency device 16. In another embodiment the printer can be connected by a universal serial bus (USB) 17. In another embodiment a separate wireless connection 33, which can be made via separate hardware 44 in one embodiment, can be used to connect the printer. In the later case, maximum bandwidth for the concurrency device over a dedicated wireless connection 32 can allow more thin clients, e.g. 18, 20, 22, etc. to operate at once with less latency than could be the case if the wireless connection were shared, depending upon the wireless connection 32 capacity and speed. Other peripheral devices 46, 48, 50, etc. can be located adjacent the processing center 12. Devices such as scanners, external media drives and other data storage

devices such as RAID arrays, and portable external hard drives, comprise examples of additional peripheral devices that can be connected. Again, the connection can be wired or wireless.

The system 10 can be configured for home use, and/or use in one of: a) a workgroup; b) a facility; and, c) an office. The processing center 12 can comprise a PC or a server, depending on the need. A PC, generally less expensive, is desirable particularly in a home network environment. A server can be used in office and other environments where higher numbers of simultaneous use of thin clients can occur. Home and smaller workgroup applications can be facilitated using older/superceded servers, which have been replaced by newer ones in an enterprise. This can result in expanding a market for used servers, and extend their usefulness.

Further, the system can be configured to facilitate connection of shared peripheral devices, e.g. 46, 48, 40...etc. In this way the processor 14 (*i.e.* the PC or server) at the processing center can become a "processing appliance," which can be upgraded independent of upgrading the UTCs *e.g.*18, 20, 22 and connected peripherals.

Whether the application is a facility, home or office, providing processing at a single location 12 and thin clients 18, 20, 22 at other locations can result in economies. Client workstations, and a server or host PC at the processing center 12, each can be located where convenient. Sharing of peripheral devices 46, 48, 50 and the centralized processor 14 by users can reduce the total costs of providing a plurality of user workstations over traditional approaches of linking PCs to each other or to a server.

Turning to FIGs. 2a and 2b, convenient placement is facilitated by the thin client communication device 30. In one embodiment this device can be a relatively small module containing a wireless connection 32 and logic, as required, to provide connections 52, 54, 56 for a monitor, keyboard, and mouse, (not shown) respectively. A power supply for the device and the mouse, and keyboard can be provided within the case of the communication device 30, connecting to a standard 120v AC power supply by a cord 58, in one embodiment, or to a power supply connecting to the standard AC socket power source in another. Furthermore, in another embodiment a shared power supply can also power the monitor (24 in FIG. 1); and, in another embodiment the monitor's power supply can provide power to the communication device 30, in turn providing power for the mouse and keyboard (28, 26, respectively, in FIG. 1). The idea of a shared power supply can be extended in one embodiment, and can provide power to all the devices connected at the thin client. This can further include speakers, microphones, image capture devices such as video cameras, etc. In another embodiment such

additional devices at the thin client can have their own power supplies. The advantage of a shared power supply, in addition to reduced cost overall, is a reduction in a number of cables, etc. at the thin client, which is aesthetically more pleasing as well as more space efficient.

With reference to FIG. 3, in one example embodiment in a home environment, a UTCN 60 can include a processing center 62, which can be a PC. The PC can be conventional, having peripherals such as media drives 64, 66, for floppy and CD/DVD/CDR, respectively, and a hard drive 68. A workstation can be provided at the processing center location including a keyboard 70, mouse 72, monitor 74, and audio speakers 76, for example. A concurrency device (not shown) can be provided in the processing center PC, to provide wireless communication to additional UTCs clients 80, 82, 84.

One ultra-thin client 80 can be very basic and relatively small in size. A communication device 86 can be carried by a monitor base 88 and share a power supply with a monitor 90. In one embodiment connections for a keyboard 92 and mouse 94 can also be made through connectors in the monitor base to the communication device. Such a thin client can be advantageously used in a kitchen environment, or other space in the home where small footprint and simplicity are desirable. Such a thin client can provide convenient access to a PC for recipes and other information, and bill paying, entertaining children, etc. This ultra-thin client can also provide convenient kitchen access to calendaring (and other scheduling), cooking, financial, and other tools and information for a family, couple, or other group of home occupants. Moreover, in a household were at least some appliance and device functions are automated (e.g. lighting, security systems, heating and cooling), and said functions can be controlled by a PC, such a thin client provides a convenient interface located in the kitchen. It can also be located in another area, as desired.

Another ultra-thin client 82 can be a conventional workstation for a home office, schoolwork, gaming, etc. just as would be provided by a PC at that location. For example, a keyboard 96, mouse 98, monitor 100, speakers 102, can be connected to a communication device 104 in wireless communication with the processing center PC 62. As mentioned, the concurrency device can be configured so that only one client at a time can access any single application program. Thus, even if two clients (*e.g.* ultra-thin client/workstation 82 and a ultra-thin client adjacent the processing center 62), are accessing a single application program, only one can do so at any one time. This can cause some latency, but allows sharing of an application running on the PC, and also allows applicable license terms to be complied with, since only one user at a time can use the program.

The system 60 can also include a plurality of shared peripheral devices. Peripherals 64, 66, 68 carried by the processing center PC 62 are examples. Other peripherals (not shown) can be connected to the processing center. These can be directly connected to the processing center via a wired or wireless connection, or can be located at a powered peripheral node (PPN), as discussed more fully below, which is wired or wirelessly connected to the processing center. The shared peripherals can be located adjacent the processing center, but especially if wirelessly connected they can be conveniently remotely located, for example adjacent a ultra-thin client 82 in another room.

Another ultra-thin client 84 can be adapted for entertainment and gaming as well as other functions. A communication device 110 as described above provides a wireless connection to the processing center 62. A monitor 112 and keyboard 114 are provided. The keyboard can itself be a wireless device, and can further include additional features such as a mouse touchpad, AV controls for audio, DVD, VCR, satellite and other TV controls, game card slots, adaptors, connectors, etc, to enable playing video and audio files, games, and other entertainment functions, as well as serve as a workstation keyboard. Thus, gaming, viewing movies, listening to audio and other video files stored on a device connected to the processing center, or delivered via Internet, cable, satellite, dial up, or another connection, can be facilitated.

It will be appreciated that advantages of the system 60 include centralizing processing at one location in one device 62. As mentioned, a single relatively powerful PC can be upgraded as needed without replacing the ultra-thin client hardware. This is less costly than replacing conventional home PCs bundled with monitors, peripherals, keyboards, etc. The hardware of the ultra-thin clients 74, 80, 82, 84 are not as susceptible to becoming obsolete. Of course, comprising essentially the communication device 86, 104, 110, or a simple PCI card or other motherboard connection of some kind (wired or wireless USB, FireWire, WiFi, Bluetooth, etc.) monitor, and other I/O devices such as keyboard, mouse, etc. Thus initial cost of the system 60 can be reduced as only one processing center is less costly. And, costs of upgrading the system can also be reduced.

As discussed above, other devices can be incorporated in the UTCN system 60, such as printer(s) scanner(s), media drive(s), hard drive(s) and RAID device(s) (not shown). And these can be directly connected to the processor by wired or wireless connections such as those discussed above. The choice of which, if any additional devices is generally dictated by the needs of the home users.

Numerous ways of implementing the home system 60 are possible. As mentioned, if the connection to one or more peripheral devices is wireless, the same wireless connection can be used as provided for the concurrency device (16 in FIG. 1) and these other devices connected to the processor, or a separate wireless connection can be provided. The communication can be by a device using USB, firewire, WiFi, Bluetooth or another protocol, connected through the PCI bus, or otherwise connected to a data bus of the processor 62. For example, some communication schemes allow connection directly to an I/O controller of the motherboard. "Built-in" USB where the chip is connected directly to the ICH4 or south bridge section of an INTEL® motherboard is an example of this later case.

With reference to FIG. 4, in another embodiment a UTCN system 120 is adapted for use in an office environment. This can be for a work group, or a relatively small enterprise-wide system. The system can include a processing center 122 comprising a powerful PC, or a server 121. A shared printer 123 can be connected to the processing center by a cable 124 or wireless connection as discussed above. The system can further include a number of thin clients 126, 128, 130, 132, 134, 136 as needed for the particular enterprise/purpose. Each thin client can include a communication device 138 as described above. In the illustrated embodiment the communication device can be carried by a monitor pedestal 140 of the ultra-thin client(s), each UTC further including a monitor 142, keyboard 144, and mouse 146 such as those discussed above.

The server 12/PC at the processing center 122 can include peripheral devices such as floppy drive(s) 148, CD, DVD, CDRW, DVDRW or other optical media drive(s) 150, hard drive(s) 152, RAID device(s)154. These are typically included examples, of bundled peripherals, in addition to the shared printer 123 at the processing center.

The shared printer can also include a powered peripheral node (PPN) 156 as shown in the illustrated embodiment. The PPN can be a module incorporating slots or bays for additional peripheral devices 158, 160 sharing a power supply, and sharing a data connection (to the processing center 122) with the printer. In the illustrated embodiment, the PPN module resides within the printer footprint, and allows connection of additional peripheral devices at that location. Further data connection ports 162, such as USB, FireWire, or other connection types, can be provided. This allows convenient connection of further devices for transfer of data to, and/or from, the system 120. Also, other devices such as plotter(s), scanner(s), image capture device(s), image projection device(s), and audio output device(s) (not shown), for example, can also be connected to the server 122 of the UTCN system 120 by wired or wireless connection(s).

The UTCN 120 configured for office use can provide the advantages mentioned above with respect to lower cost requirements to implement and upgrade the system. Due to centralization of the processing function and sharing of peripheral devices 123, 158, 160, etc., a considerable advantage in convenience of maintaining the system, adding additional software, replacing defective devices, and space savings is also realized. Moreover, the processing center and peripherals can be isolated from locations which may be inappropriate due to temperature, particulates, humidity, etc. while allowing access from those locations by a relatively more robust and low-cost UTC, *e.g.* 136 having relatively fewer vulnerable components, or as to which mitigation measurers are more easily implemented. This can be advantageous in a manufacturing enterprise for example, where access to the system 120 from a shop floor is desirable, but where locating a conventional PC-based workstation would be problematic.

Further details will be appreciated now with reference now to FIG. 5. In another embodiment configured for a home, student housing, internet café, or other environment where a number of different users having differing needs will use the system, a UTCN system 150 can be configured differently. In this embodiment a number of ultra-thin clients 152, 154, 156, 158, 160, 162 are connected to a processing center 164 in each case by one of two wireless connections 166, 168.

As mentioned above, a processor 170 can be connected to a system data bus 172, and further a peripheral connection interface (PCI) 174 can be provided. Data can be directed to peripherals directly to and from the PCI, or as discussed above, via the concurrency device 176. The concurrency device is on a PCI card connected to the interface in one embodiment. A Universal Serial Bus (USB) can also be connected to the system bus 172 through the PCI, and a USB card 178 is provided for this purpose in the illustrated embodiment. The system can also include other data conduits, such as a FireWire port 180 (or multiple ports) connected via a FireWire card 182 to the PCI 174.

As mentioned, the concurrency device 176 can be configured with a wireless connection transponder on the same card, or can be connected to a separate wireless connection device 184 as shown. The USB can also be connected to a wireless connection device 186, separate from the device used by the concurrency device to preserve speed in the concurrency connections.

The system 150 can include a powered peripheral node (PPN) *e.g.* 154, 156, as will be discussed further below. A PPN can be data-connected by a wireless connection to the

processing center 164. In this latter way the PPN can facilitate convenient connecting and placement of peripheral devices, which can be shared by users on the system without cabling.

As is known, many peripherals can be connected via a USB. In the illustrated embodiment certain thin clients 152, 158, 160, 162 are connected to the processor 170 via a first wireless connection 166 through the wireless device 184 used by the concurrency device 176. But certain others comprise shared peripheral devices and are connected through the second wireless connection 168. For example, a PPN is created at one client 154 as mentioned. A power supply 190 provides power to a communication device 192 providing the wireless data connection and to three additional peripheral devices 194, 196, 198 which can be selected from USB compatible devices such as optical and magnetic media drives, hard drives, cameras, scanners, projectors, etc. These peripherals are data-connected to the processing center 164 via the wireless data connection 168 through the USB PCI card 178, 174.

Continuing with discussion of the system 150 illustrated in FIG. 5, another thin client comprises a printer-attached PPN, comprising a shared printer 200, including a printer power supply 202. The power supply also provides power to a wireless connection transponder 204 providing a wireless connection 168 with the processing center via the USB connection route described above including a processing center transponder 186, USB card 178, PCI 174 to the system bus 172. Additional peripherals 206, 208 can be provided at the PPN, for example such as those described above in connection with the PPN at the previously described thin client 154.

Because of the wireless data connection 168 between these peripheral node clients 154, 156 they can be conveniently placed in a home in relation to the processing center 164 and the other thin clients 152, 158, 160, 162, for shared use.

As discussed, the thin clients 152-162 can be individually configured according to the location and uses to which they are put. For example one thin client, 158, can be configured for entertainment and gaming, and can comprise a monitor 220, speakers 222, a gaming console 224 all connected to the processing center by a wireless communication device 226 providing the client end of the wireless data connection 166 with the processor 170 through the concurrency device 176.

One UTC 160 can be very streamlined and adapted for use in a kitchen, hobby shop, and garage area, to name a few examples of locations where a smaller, or more robust client is desirable. It can include a small monitor 228 supporting a communication device 230

which connects the monitor, and a keyboard 232 and mouse 234 to the processing center via the wireless data link 166 associated with the concurrency device 176.

The ultra-thin clients 162, 152 in the illustrated example system 150 each include a monitor 236 keyboard 238 and mouse 240. Depending upon user preferences, other devices such as speakers 242 at one thin client 162 can be provided.

While a home embodiment 150 has just been described, it will be appreciated with reference to all the embodiments discussed above that the concept allows great flexibility in creating a network for many different circumstances. Workgroups, small businesses, homes, student housing, small municipalities, to name some examples, may be able to advantageously use such a system. Cost savings can be realized, and also an increase in convenience in setting up and using such a system are made possible.

With reference to FIGs. 1 and 5, another way of thinking of the invention is in terms of a method of providing an ultra-thin client network 10, 150, comprising providing a processing center 12 including a processor 14 and a system bus 15, and providing a concurrency device16 connectable to the system bus, said concurrency device enabling connection of multiple ultra-thin clients *e.g.*18, 20, 22 to the processor. The method includes providing for connection of the plurality of thin clients through the concurrency device and, providing a wireless connection 32 configured to enable data communication between the concurrency device and the thin clients. Further, the method includes configuring the concurrency device and the wireless connection so that the thin clients can share the processor from convenient remote locations without cabling via the concurrency device and the wireless connection.

In a more detailed aspect the method can further comprise the step of providing for connection of a plurality of shared peripheral devices *e.g.* 46, 48, 50 to the system data bus, whereby users at the thin clients can share the peripheral devices. It can also further comprise the steps of providing a PPN *e.g.*154, 156; and, configuring the PPN for connecting a plurality of peripherals *e.g.* 194, 196, 198, 200, 206, 208 to the processing center through the PPN. It can also include the step of providing a wireless data connection 168 between the PPN and the processing center.

Moreover, in a further detailed aspect, a wireless UTCN 10 is facilitated by providing a concurrency device 16 incorporated in a PCI card. In a further detailed aspect, in providing the communication device 30 at the thin client(s) 18, 20,22, etc., the communication device can be supplied power by, supply power to, or share a power supply with, a monitor 24, keyboard 26, and/or mouse 28, and/or other connected peripheral device(s) at the thin client

location. Thus using this method, certain devices can be combined, and a system can be economically implemented.

Furthermore, as will be appreciated from the foregoing, easier and more convenient connectivity can be provided by implementation of the invention. The system 10, 60, 120, 150 provides increased opportunities for synergistic and advantageous combination of devices, thereby increasing the convenience of use of the system 10, and/or extending its capability and interoperability. Moreover, providing these advantages and enabling lower costs is possible with systems in accordance with principles of the invention. Also, more convenient means of implementation of computing in the office, mobile office and in the home are made possible thereby.

While features of exemplary embodiments have been shown in the appended drawings and described herein, it will be understood that various modifications can be made without departing from the spirit and scope of the invention. It is not intended that the scope of the invention as set forth in the claims be limited to the examples described, and no such limitation should be inferred.